VOL. XII. JANUARY, 1931 No. 7.

The American Midland Naturalist

Devoted to Natural History, Primarily that of the Prairie States

Published by the University of Notre Dame, Notre Dame, Indiana

PRICE, $1.50 A YEAR SINGLE NUMBERS, 30 CENTS FOREIGN, 6s, 6d.

Entered as second-class matter at Notre Dame, Ind. Acceptance for mailing at special rate of postage provided for in section 1103, Act of October 3, 1917, authorized on July 3, 1918.

THE UNIVERSITY PRESS, NOTRE DAME, INDIANA

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The American Midland Naturalist

PUBLISHED BI-MONTHLY BY THE UNIVERSITY OF NOTRE DAME.
NOTRE DAME, INDIANA.

Vol. XII JANUARY, 1931 No. 7

FRANCIS DANIELS' CARICES

BENJAMIN FRANKLIN BUSH

Very few people, probably, have ever seen the "Flora of Columbia, Missouri, and Vicinity," by Francis Daniels, published in 1907.

This is a many-paged ecological and taxonomic study of practically the whole of Boone County, and the printed portion is accompanied by a large map showing the localities where the study and collections were made.

The systematic portion of this work deals with about 1,100 species and varieties of plants found in the territory under consideration. Of the genus *Carex* there are listed 51 species and varieties, which is somewhat less than half the number that are known for the State.

As there was a great deal done in clearing up the species of *Carex* from 1895 to 1905, it would seem that Daniels did not keep up with the progress made in the study of the species by a number of caricologists.

I have quite recently received Daniels' collection of Carices, and incidentally all the *Carex* material collected in Missouri in the Herbarium of the University of Missouri, and an examination of this material has prompted me to write this paper.

A cursory reading by any one familiar with *Carex* species, of the list of Carices in Daniels' Flora, will show that it has quite a number of species and varieties of *Carex* listed that can not be maintained as Missouri species, and that it does

not contain quite a number of common and abundant species, which most certainly must occur in Boone County.

In this examination of Daniels' carices I have found only 28 species which he has in his list, 23 species not being represented by any specimens so named by Daniels, and I have found several species collected by him that he failed to identify or determine correctly.

Mr. Mackenzie has very kindly examined and reported on a number of specimens that were doubtful to me, for which I am indebted.

The following list is in accordance with Daniels' arrangement, numbering and naming.

170. CAREX LEAVENWORTHII Dewey, 1846.
This species is represented in Daniels' collection by four different species.
Columbia, *Daniels*, May, 1897, and June, 1903, two sheets, all as *C. Sartwellii;*
Columbia, *Daniels*, June, 1903, three sheets, as *C. interior;*
Columbia, *Daniels*, July, 1903, as *C. cephaloidea;*
Columbia, *Daniels*, June 1, 1902, as *C. Leavenworthii.*

171. CAREX CEPHALOPHORA Muhl. 1805.
Under two names in the Daniels' collection.
Columbia, *Daniels*, June, 1903, as *C. cephaloidea;*
Columbia, *Daniels*, July, 1903, as *C. cephalophora.*

172. *Carex cephaloidea* Dewey, 1849.
The two specimens so named in Daniels' collection are referred to *C. Leavenworthii* and *C. cephalophora.*

173. *Carex Muhlenbergii Xalapensis* (Kunth) Britton.
Not now regarded as distinct from the specific form, which was not listed by Daniels. The specimens so named are referred to *C. plana.*

174. *Carex retroflexa* Muhl. 1805.
No specimen under this name was found in the Daniels collection, but there were two sheets of this species as follows: Columbia, *Daniels*, July, 1930, two sheets, as *C. interior*.

175. *Carex texensis* (Torr.) Bailey, 1894.
No specimens of this species under any name are in the University collection, the specimens so named being *C. rosea*.

176. CAREX ROSEA Schkuhr, 1805.
This species is represented in the Daniels collection under three names.

Columbia, *Daniels*, May, 1903, as *C. rosea;*

Columbia, *Daniels*, July 4, 1902, and July, 1903, four sheets, all as *C. retroflexa;*

Columbia, *Daniels*, May 8, 1902, two sheets, as *C. texensis*.

177. *Carex Sartwellii* Dewey, 1842.
No specimens under any name were found in the University collection, but there is one sheet so named that is referred to *C. Leavenworthii*.

178. CAREX VULPINOIDEA Michx. 1803.
Columbia, *Daniels*, July 3, 1930, two sheets, June, 1903, all as *C. vulpinoidea;*
Sapp, *Rickett*, July 4, 1929, as *C. vulpinoidea*.

179. *Carex gravida* Bailey, 1889.
No specimens of this species are in the University collection under any name.

179A. *Carex gravida laxifolia* Bailey, 1889.
This is now regarded the same as the specific form, and no specimens under any name were found in the University collection, the two sheets bearing this name being referred to *C. sparganioides*, a species Daniels does not include in his list.

180. CAREX CONJUNCTA Boott, 1862.
Columbia, *Daniels,* June, 1903, July, 1903, two sheets, and May 28, 1902, all as *C. conjuncta.*

181. CAREX STIPATA Muhl. 1805.
Columbia, *Daniels,* June, 1905, as *C. stipata.*

182. CAREX CRUS-CORVI Shuttlw. 1844.
Columbia, *Daniels,* July, 1903, as *C. Crus-corvi;*
Boone County, *Daniels,* July 20, 1903, two sheets, as *C. Crus-corvi.*

183. *Carex interior* Bailey, 1893.
No specimens under any name were found in the University collection, but there are two sheets bearing this name that were referred to *C. retroflexa* and *C. Leavenworthii.*

184. CAREX TRIBULOIDES Wahl. 1803.
This species is represented in the Daniels collection under two names.

Columbia, *Daniels,* July 3, 1903, as *C. tribuloides;*
Columbia, *Daniels,* July 3, 1903, three sheets, and July, 1903, all as *C. cristatella.*

184A. *Carex tribuloides Bebbii* Bailey, 1889.
No specimens of this variety under any name were found in the University collection, but there is one sheet so named which was referred to *C. tribuloides sangamonensis.*

184B. *Carex tribuloides moniliformis* (Tuckerm.) Britton, 1896.
No specimens of this variety under any name were found in the University collection, but there is a specimen so named which was referred to *C. tribuloides sangamonensis.*

185. CAREX CRISTATELLA Britton, 1896.
Columbia, *Tracy,* July 17, 1886, as *C. cristata;*
There are three sheets as follows:

Columbia, *Daniels*, July 3, 1903, all named *C. cristatella*, that are referred to *C. tribuloides*.

I am therefore in doubt whether Daniels was correct in listing this species, as his specimens do not represent it, and I can not be sure now if he did base this species on Tracy's specimen.

186. *Carex scoparia* Schkuhr, 1805.
No specimens of this species under any name were found in the Daniels collection, but there is one in the University collection as follows:
Jackson County, *Bush*, June 4, 1888, as *C. scoparia*.

187. *Carex straminea* Willd. 1801.
No specimens of this species under any name were found in the University collection, but there are two sheets so named that were referred to *C. tenera* and *C. mirabilis*.

188. CAREX MIRABILIS Dewey, 1836.
Columbia, *Daniels*, July, 1903, as *C. straminea mirabilis*; Columbia, *Daniels*, July, 1903, as *C. straminea*.

189. *Carex tenera* Dewey, 1824.
No specimens of this species so named by Daniels were found in the University collection. There is, however, a specimen of this species as follows:

Columbia, *Daniels*, June 25, 1902, as *C. straminea*.

190. CAREX JAMESII Schwein, 1824.
Columbia, *Daniels*, June, 1903, two sheets, May 7, 1902, and May 15, 1902, all as *C. Jamesii*.

191. CAREX CRINITA Lam. 1789.
Boone County, *Favor*, May 18, 1901, two sheets as *C. crinita*.

192. CAREX PUBESENS Muhl. 1805.
Columbia, *Daniels*, June, 1903, as *C. pubescens*.

193. *Carex umbellata vicina* Dewey, 1826.
Not now regarded as distinct from the specific form which is not given by Daniels, nor was any specimen of the species or variety found in the University collection under any name.

194. CAREX PENNSYLVANICA Lam. 1789.
The western form has been separated from the eastern by Mr. Mackenzie, as *C. heliophila*, which name the Missouri species may bear, and it is represented in the University collection as follows:

Columbia, *Daniels*, April, 1903, as *C. pennsylvanica;*
Columbia, *Virginia Dyer*, April 17, 1902, as *C. pennsylvanica.*

There is a sheet bearing this name in the collection which has been referred to *C. varia*, a species Daniels did not list in his flora.

195. CAREX SETIFOLIA (Dewey) Britton, 1896.
Boone County, *Daniels*, May 9, 1905, and May 9, 1906, both as *C. setifolia.*

196. CAREX ALBURSINA Sheldon, 1893.
Columbia, *Daniels*, June, 1903, two sheets, June 13, 1903, June, 1904, two sheets, and July 4, 1902, all as *C. albursina.*

197. *Carex laxiflora* Lam. 1789.
No specimens of this species under any name were found in the University collection, all the sheets so named being referred to *C. blanda* and *C. Hitchcockiana.*

197A. *Carex laxiflora varians* Bailey, 1889.
This is now considered equivalent to *C. blanda*, and the sheets so named are referred to *C. blanda* and *C. grisea.*

198. CAREX BLANDA Dewey, 1826.
A very common and extremely variable species, judging by the number of collections and names given to the

specimens, and probably the most collected species in Missouri.

Columbia, *Daniels*, June, 1903, as *C. laxiflora gracillima*, a name not in Daniels' list;

Columbia, *Daniels*, May 28, 1902, July 4, 1902, and June, 1903, three sheets, all as *C. laxiflora;*

Columbia, *Daniels*, June, 1903, two sheets, and June 1, 1902, all as *C. laxiflora varians;*

Rocheport, *Rickett*, May 5, 1929, as *C. laxiflora gracillima.*

199. CAREX HITCHCOCKIANA Dewey, 1826.
Columbia, *Daniels*, June, 1903, June 13, 1903, and July, 1903, all as *C. Hitchcockiana;*

Columbia, *Daniels*, May, 1903, as *C. laxiflora.*

200. CAREX OLIGOCARPA Schkuhr, 1805.
Columbia, *Daniels*, June, 1903, two sheets, May, 1897, June 9, 1902, two sheets, and June 1, 1902, all as *C. oligocarpa.*

201. *Carex conoidea* Schkuhr, 1805.
No specimens of this species under any name were found in the University collection.

202. CAREX GRANULARIS Muhl. 1805.
Columbia, *Daniels*, May 28, 1902, four sheets, June 13, 1903, all as *C. granularis.*

203. CAREX GLAUCODEA Tuckerm. 1868.
Columbia, *Daniels*, July, 1903, three sheets, July 7, 1903, all as *C. glaucodea.*

204. *Carex amphibola* Steud. 1885.
No specimens of this species under any name were found in the University collection, all those so named being *C. grisea.*

205. CAREX GRISEA Wahl. 1803.
Columbia, *Daniels*, June, 1903, and May 28, 1902, three sheets, all as *C. grisea;*
Columbia, *Daniels*, June 13, 1903, and June, 1904, all *C. amphibola.*
Columbia, *Daniels*, July, 1903, as *C. laxiflora varians.*

206. CAREX DAVISII Schwein. & Torr. 1825.
Columbia, *Daniels*, June, 1903, June 1, 1902, April, 1897, and July 13, 1903, as *C. Davisii.*

207. *Carex caroliniana* Schwein. 1824.
No specimens of this species under any name were found in the Boone County collection.

208. *Carex triceps* Michx. 1803.
No specimens of this species under any name were found in the University collection.

209. CAREX LUPULINA Muhl. 1805.
Columbia, *Daniels*, July 20, 1903, four sheets, July, 1903, two sheets, and July, 1904, all as *C. lupulina;*
Columbia, *Galloway*, August 1, 1884, as *C. lupulina;*
Columbia, *Rickett*, July 13, 1929, as *C. lupulina.*

209A. *Carex lupulina pedunculata* Dewey, 1870.
Not now regarded as distinct from the typical form, and no specimens of the variety under this name were found in the University collection.

210. *Carex utriculata* Boott, 1840.
No specimens of this species under any name were found in the University collection.

211. CAREX FRANKII Kunth, 1837.
Columbia, *Daniels*, July 3, 1903, June 26, 1902, two sheets, as *C. Frankii;*
Columbia, *Daniels*, June, 1897, as *C. stenolepis;*
Columbia, *Rickett*, July 20, 1927, as *C. Frankii.*

212. CAREX SQUARROSA L. 1753.
Columbia, *Daniels,* June 13, 1903, as *C. squarrosa;*

Boone County, *Daniels,* July, 1903, two sheets, June, 1903, two sheets, July 21, 1903, and July 20, 1903, all as *C. squarrosa.*

213. CAREX TYPHINOIDES Schwein. 1824.
Columbia, *Daniels,* July, 1903, three sheets, and July 21, 1903, all as *C. typhinoides.*

214. *Carex aristata* R. Br. 1823.
No specimens of this species under any name were found in the University collection. Several specimens so named were referred to *C. impressa,* a species not included by Daniels in his list.

215. CAREX SHORTIANA Dewey, 1836.
Columbia, *Daniels,* July 5, 1903, two sheets, May 28, 1902, three sheets, May, 1897, and June, 1903, all as *C. Shortiana;*

Columbia, *Tracy,* May 24, 1886, as *C. Shortiana.*

The following species were collected by Daniels, but were either not identified by him or were unknown to him. I am appending this short list to merely bring Daniels' list up to date, and complete as far as I now can the *Carex* flora of Boone County.

1. CAREX PLANA Mack.
Columbia, *Daniels,* July, 1903, as *C. Muhlenbergii xalapensis.*

2. CAREX FESTUCACEA Schkuhr, 1805.
Columbia, *Daniels,* May, 1897, as *C. straminea aperta,* which name is not in Daniels' list.

3. CAREX IMPRESSA (S. H. Wright) Mack. 1910.
Columbia, *Daniels,* June, 1904, and June, 1905, as *C. aristata.*

4. CAREX MICRORHYNCHA Mack.
Columbia, *Daniels*, July, 1903, and July 13, 1903, as *C. gravida laxifolia.*
Columbia, *Daniels*, April, 1904, as *C. umbellata vicina.*

5. CAREX SPARGANIOIDES Muhl. 1805.
Columbia, *Daniels*, July, 1903, and July 13, 1903, as *C. gravida laxifolia.*

6. CAREX HIRSUTELLA Mack.
Columbia, *Daniels*, July, 1903, four sheets, and June 13, 1903, as *C. triceps;*
Boone County, collector not given, June 5, 1886, as *C. Shortiana;*
Columbia, *Rickett*, June 23, 1929, as *C. triceps hirsuta.*

7. CAREX TRIBULOIDES SANGAMONENSIS Clokey.
Columbia, *Daniels*, July, 1903, as *C. scoparia;*
Columbia, *Daniels*, July 3, 1903, two sheets, as *C. tribuloides moniliformis;*
Columbia, *Daniels*, July 5, 1903, as *C. tribuloides Bebbii.*

8. CAREX VARIA Muhl. 1803.
Columbia, *Daniels*, May 15, 1902, and April, 1903, as *C. pennsylvanica;*
Columbia, *Virginia Dyer*, April 17, 1902, as *C. pennsylvanica.*

A DEVONIAN STROMATOPOROID REEF[1]

MILDRED ADAMS FENTON

True reefs—as distinguished from massive beds—formed by stromatoporoids and stromatoporoid detritus have been recorded infrequently. Thus Cumings and Shrock, in their discussion of Niagaran reefs,[2] do not stress the importance of these organisms in the building of reefs, even though they describe one reef whose central mass, or "core rock is a breccia or sand of stromatoporoid and other organic fragments, extremely diagenized and reduced to a porous, inchoate, mealy mass." In the Devonian, where stromatoporoids attain their maximum, we find numerous records of coral reefs; but few or none of reefs built by stromatoporoids. An example of this is Grabau's description of coral reefs in the Traverse of Michigan, while he records only worn fragments from reef margins in which stromatoporoids also are important,[3] and mentions no reefs in which stromatoporoids are the dominant organisms.

More recent quarrying near Petoskey has exposed such a reef, or series of reefs, which it is the purpose of this paper to describe. Their general setting is shown in Plate I: a quarry in limestone along the shore of Little Traverse Bay, in the eastern part of the city of Petoskey, Emmet, County, Michigan. A generalized section of the strata exposed has been published by Pohl,[4] but since he avoids some of the details necessary to bring out the characteristics of the reefs, a section made while studying them may be given here:

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[1] Contributions from the University of Cincinnati Museum. Geology and Paleontology. Number 14. Read before the Paleontological Society, December 28, 1928.

[2] Bull. Geol. Soc. Am., vol. 39, pp. 579-620, 1928.

[3] Bull. Geol. Soc. Am., vol. 14, pp. 338-340, 1903.

[4] Proc. U. S. Nat. Mus., vol. 76, art. 14 (pub. 2811), p. 14, 1930.

SECTION IN THE NORTHERN LIME COMPANY'S QUARRY PETOSKEY, MICHIGAN

	Feet	Inches
15. Dolomite, coarse, yellow-brown, with apparent fucoidal cavities; much weathered	8	
14. Limestone, granular, gray-buff, much shattered, with abundant stylolites	4–7	
13. Limestone, granular, buff to gray-brown. At the western end of the quarry the upper 4 feet contain *Idiostroma* (?) *caespitosum* (Winchell) in abundance; also *Gypidula* and *Atrypa*. Eastward, *Idiostroma* (?) becomes less common, while the lower 3 feet bear stromatoporoids and *Cylindrophyllum panicum* (Winchell)	6	
Unconformity (Un. 2, Fig. 1).		
12. Limestone, dolomitic, granular, in massive beds. Stromatoporoids abundant, concentric, subspheroidal; within the limits of the reef, most of them are fragmentary. *Favosites* and *Cylindrophyllum* present as uncommon fragments	6–8	
11. Limestone, fine-grained, buff, somewhat shattered; crowded by subspheroidal stromatoporoids 4 to 10 inches in diameter. Lower surface undulating; thickness increases within the limits of the reef, and some distance away from it	3–5	
Minor Unconformity (Un. 1, Fig. 1).		
10. Limestone, dolomitic, granular, brownish, in massive beds except where it forms the thinly-bedded, coarse rock of the fore-reef. Within the reef it consists of a matrix of lime sand crowded with broken stromatoporoids. Away from the reef the stromatoporoids are very large (maximum diameter, 5 feet) and show neither fracture nor disturbance; the lowermost rest in position of growth on No. 9, except in a few places where an indistinct basal conglomerate intervenes	12–15	

Unconformity (R. M., Fig. 1).

	Feet	Inches
9. Limestone, shaly, gray, with plastic carbonaceous layers which seem to be cross-bedded. Upper surface undulating, apparently ripple-marked	1	2–3
8. Limestone, fine-grained, compact, gray-buff		4–6
7. Limestone, lithographic in texture, light gray. Upper portion marked by irregular, thin carbonaceous layers	2	
6. Clay-shale, grayish brown		1–2
5. Limestone, fine-grained, white to light buff, in thick beds	4	6
4. Shale, gray to black, commonly plastic. Grades into No. 5 in some spots; lacking in others		0–4
3. Limestone, fine-grained, gray, irregularly bedded, with irregularly disposed black bands. *Favosites* common; stromatoporoids few and small	4	8
2. Shale, plastic, carbonaceous, black, containing corals and brachiopods. A persistent member		1
1. Limestone, coarse, sandy, brownish-gray, with thin carbonaceous bands 1 to 6 inches apart. Bedding thick; stromatoporoids rather few. To floor	4	

(Numbers 1 to 3 may be seen in the eastern part of the quarry. In the vicinity of the reef they become more thinly bedded and grade into the fore-reef of Reef 1, the line of contact being hidden by debris.)

Of these strata, Numbers 1 to 9 apparently correspond to Beds 5, 6 and 7 of the Charlevoix stage as divided by Pohl.[5] Numbers 10 to 12 are encompassed in Zone 1 and Bed 1 of Pohl's Petoskey Formation; Number 13 equals Bed 2 of that formation, while Numbers 14 and 15 correspond to Bed 3. Differences in thickness between the two sections may be explained by fluctuations in the strata, which vary considerably within the limits of the quarry.

[5] Proc. U. S. Nat. Mus., vol. 76, art. 14 (pub. 2811), p. 14, 1930.

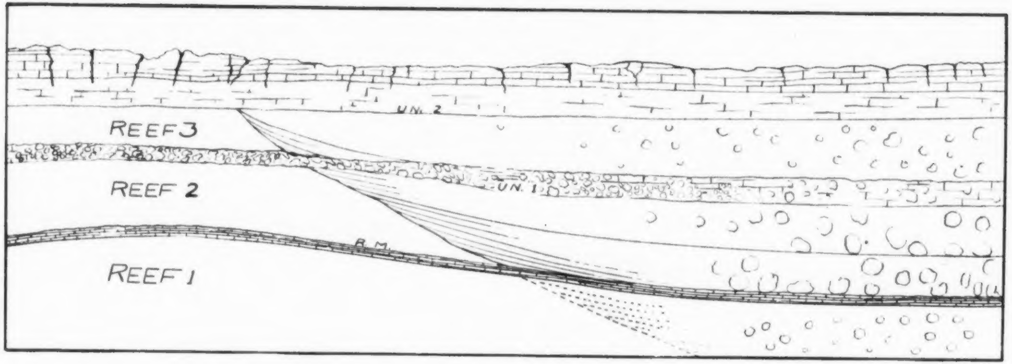

Fig. 1. Diagrammatic section, showing the relationships of the reefs and associated beds of the quarry wall illustrated in Plate I.

The major divisions of the section, and the relationships of reefs and fore-reefs, are shown in Figure 1, which is a diagrammatic representation of the quarry face extending southward and westward from the portion shown in Plate I, plus the lowermost beds seen in the eastern part of the quarry. Thus the domed quarry floor seen in Plate I appears in Figure 1 as the surface of a basal, dome-shaped reef, of which Numbers 1 to 3 of the section form the fore-reef. It is separated from Reef 2 by fine, thinly bedded, banded limestones and carbonaceous shales, whose upper surface bears irregular ripples ten to twenty inches from crest to crest. These are best seen some distance away from the reef itself, in the eastern part of the quarry. There, as may be seen from Plate II, large stromatoporoids rest in position of growth directly upon the undulating surface, with only here and there intervening thicknesses of limestone conglomerate.

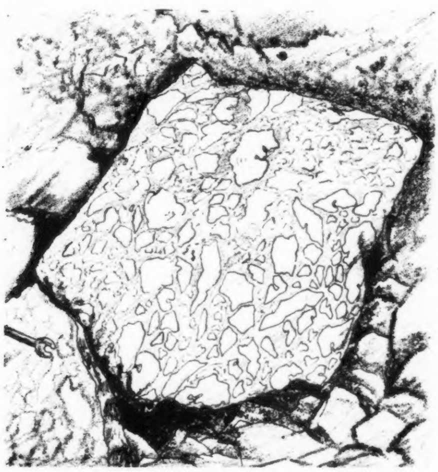

FIG. 2. A block of limestone freshly blasted from Reef 2, showing the angular, fragmentary condition of the stromatoporoids. Height of block about six feet.

According to Pohl, this undulating surface is a line of unconformity separating the Charlevoix Stage from the Petoskey Formation above. As a boundary line between two formations none too well distinguished lithologically it serves well; but as an unconformity it is less striking than either of the two which appear above it in the Petoskey quarry, since both of them truncate underlying beds. The fact, furthermore, that in spite of some erosion, the reef association became re-established directly above the existing reef, seems to indicate that the Charlevoix-Petoskey interval was of short duration. Probably the conditions were analogous to those which, in the Upper Devonian (Shellrock and Cedar Valley) of Iowa, produced numerous unconformities, some of which involve the removal of several feet of sediments, yet failed to seriously change the faunas involved.

The second reef (Reef 2, Figure 1) ranges from ten to twelve feet in thickness, and shows marked thickening peripherally. As noted in the section, it consists of massive, grainy limestone apparently formed almost entirely by stromatoporoid sand. In it are embedded a few unbroken stromatoporoids ranging to eighteen inches in diameter; but for the most part the fossils consist of countless fragmentary stromatoporoids whose sizes range from that of the largest complete ones down almost to sand. All are shown in blocks, such as the one seen in Figure 2, which are freshly blasted from the quarry wall. Away from the reef the size and completeness of the stromatoporoid colonies increase until, well beyond the fore-reef, they attain the dimensions of those in Plate II, in which one stromatoporoid may be seen whose maximum diameter is about five feet.

The marginal thickening of Reef 2 finds its explanation in the fact that the surface of the reef, as well as of adjoining beds is nearly a plane; both are truncated by a sharp, though apparently minor unconformity, indicated as Un. 1 in Figure 1. Above it is a bed of relatively small nodular stromatoporoids, two to three feet thick in the region of the reef, but reaching five feet some distance away from it. Upon this

bed the reef resumed growth for a third time, producing rock much like that forming Reef 2 except that the contained fragments of stromatoporoids are smaller. The margin of the reef is steeper, also, than that of its immediate predecessor, and the dips in the fore-reef are proportionately greater. Final destruction of the reef seems to have been accomplished by a third interval of erosion, which is represented by an unconformity sharply truncating the fore-reef and the reef. It is succeeded by dolomitic limestones bearing *Cylindrophyllum panicum* (Winchell) and *Idiostroma caespitosum* (Winchell) in abundance, as well as *Favosites* and a few brachiopods. Faunally, this seems to be the most pronounced break in the entire section.

Of the stromatoporoids which compose the reefs, little can be said. In the main they seem to represent two species, one small with closely spaced mammilons, the other large and coarsely marked. In sections, the astrorhizal systems and laminae may be distinguished; but since virtually all specimens are preserved in a contracted state, identification is difficult. The general characters suggest species of *Stromatopora*, with some of the peculiarities of *Syringostroma*, the variation being due to varying degrees of contraction. Forms in a like state are known from both the Devonian and the Silurian, generally being referred to the genus *Syringostroma*.

From data at hand, it seems that this contraction of the stromatoporoids, while perhaps an insuperable obstacle to taxonomic determination of the forms affected, is an important aid to their fossilization. In several cases, stromatoporoids of firm texture, associated with apparently stromatoporoid sand, have been found to resemble closely contracted Demospongiae, thus indicating that the contraction was a major—perhaps an essential—factor in their prompt and thorough preservation. And this seems essential if they are to furnish material either for true reefs, like the ones here described, or for massive beds in which stromatoporoids are the chief constituents.

EXPLANATION OF PLATES

Plate I.

Portion of the quarry of the Northern Lime Company, Petoskey, Michigan. The surface of the lowest reef forms the quarry floor; the second and third reefs appear at the left; the beds of the fore-reef in the center and at the right.

Plate II.

Large stromatoporoids in position of growth upon the undulating surface separating the Charlevoix and Petoskey formations of Pohl.

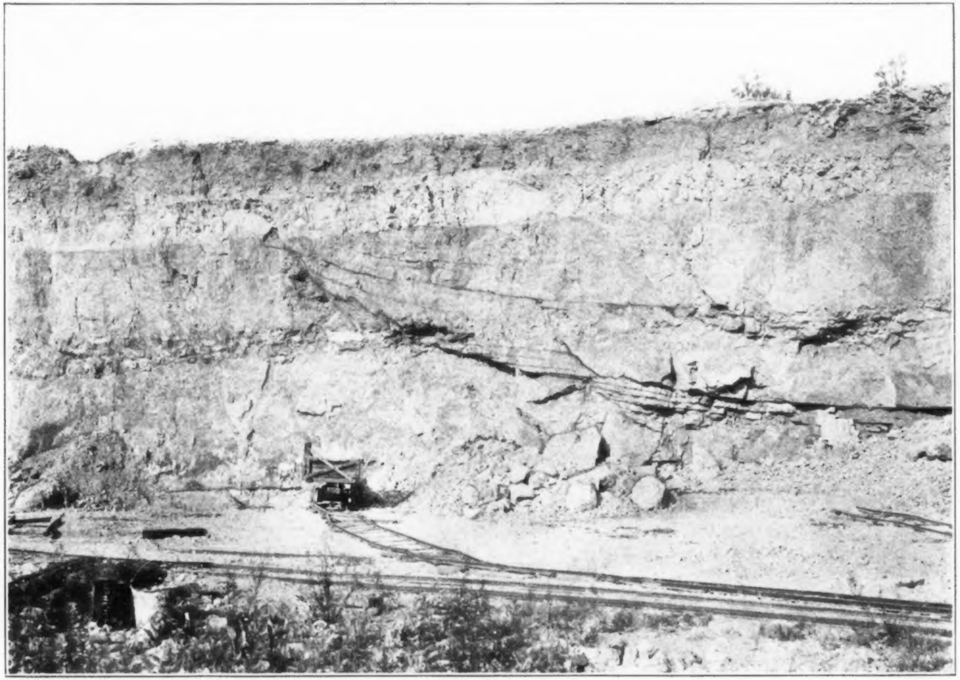

Plate I

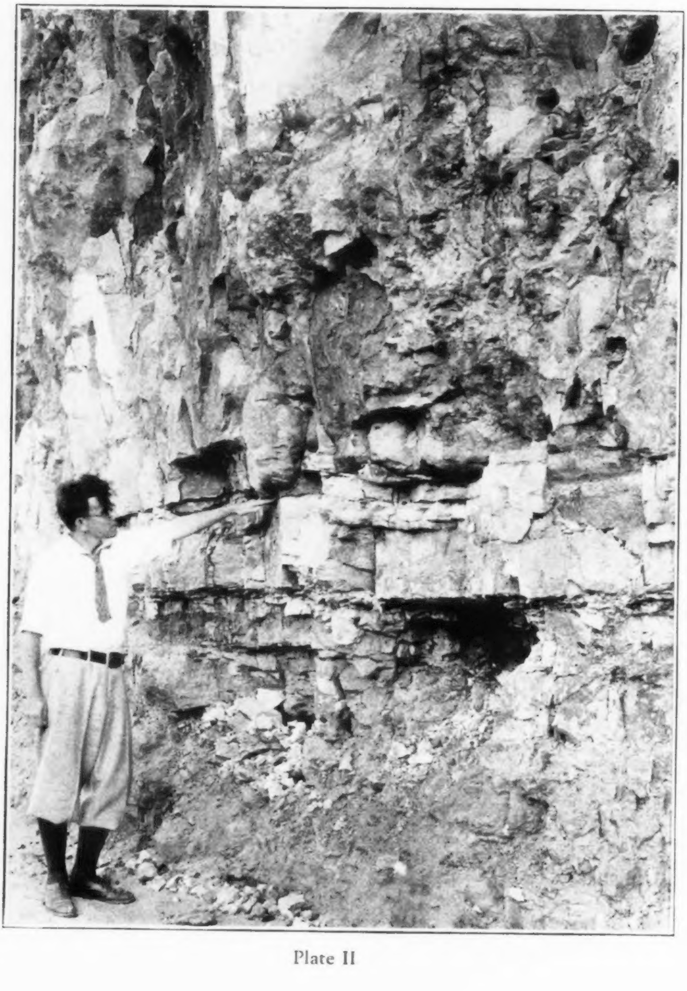

Plate II

NIAGARAN STROMATOPOROID REEFS OF THE CHICAGO REGION

CARROLL LANE FENTON

I. INTRODUCTION

The existence of reef structure in the Niagaran (Guelph, Racine) strata of southeastern Wisconsin and northeastern Illinois long has been known. Since Chamberlin's initial descriptions,[1] however, they generally have been regarded as coral reefs, though a few authors, such as Bannister[2] and Alden,[3] have regarded them as the result of warping. It is true that some, especially Grabau[4] and Cumings and Shrock,[5] have called attention to the presence of other organisms, notably stromatoporoids, in these and in similar reefs in Indiana; but in no case has serious effort been made to appraise the importance of such organisms as the primary builders of the reefs.

In 1919, while a student under Dr. J Harlen Bretz, of the University of Chicago, I first examined the more familiar reefs of the Chicago region: those forming the broad, low elevation known as Stony Island and others exposed in quarries at Thornton and McCook Station. Having but recently worked in the Upper Devonian region of north-central Iowa, where coral reefs seemingly are lacking (Vaughan's reference to reefs of *Pachyphyllum* in that state[6] seems to lack basis), but where stromatoporoids are abundant and form thick beds sometimes referred to as reefs, I at once sought evidence of their part in the formation of the Illinois reefs. It was not hard to find; and

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1 Geology of Wisconsin, vol. 2, pp. 363-371, 1877.
2 Geol. Surv. Ill., vol. 3, pp. 246 ff., 1868.
3 U. S. Geol. Surv., Geol. Atlas, Folio 81, 1902.
4 Bull. Geol. Soc. Am., vol. 14, p. 341, 1903.
5 Bull. Geol. Soc. Am., vol. 39, p. 601, 1928.
6 Bull. Geol. Soc. Am., vol. 22, p. 245, 1911.

subsequent visits convinced me that stromatoporoids were the chief organic constituents of the structures, their only rivals being the tabulate "corals." Since the true stromatoporoids, in the opinion of Twitchell,[7] are sponges of the group Demospongiae; and the tabulates, although regarded as Alcyonaria by Swinnerton,[8] make excellent bryozoans but rather poor corals, the designation of coral reefs, when applied to the structures in question, seems inappropriate. Indeed, if the interpretations just suggested are valid, the reefs do not owe their existence even to members of the phylum Coelenterata.

II. ORGANISMS OF THE REEFS

In visits ranging from 1919 to 1925, fossils were collected from the Thornton, McCook and Stony Island reefs, while collections made by field classes during those years also were examined. All supported the initial conclusion that true corals form a small part of the reefs, and formed a proportionately small element in their biota during the Niagaran epoch. A few cup corals, largely unidentifiable, and two species of *Pycnostylus*, formed the bulk of the coralline population. Their small size, as well as their relatively scanty numbers, points to a minor position in the volume of reef material.

The tabulates make a better showing. *Favosites*, *Halysites* and *Cladopora* are the commonest genera, with the former two contributing most largely to the reef masses, as well as to the broken material of the fore-reefs. Yet even the most generous allowance fails to place them foremost among the reef-building organisms.

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7 American Midland Naturalist, vol. 11, pp. 270-306, 1929. In this paper Twitchell removes many of the so-called stromatoporoids from that group; and in a recent letter he states that new sections are showing the algal nature of many of the supposed idiostromids of the Iowa Devonian.

8 Outlines of Paleontology, pp. 48-50, 1923.

Stromatoporoids occur abundantly in the reef masses and in the fore-reefs; yet they readily may be overlooked because of their resemblance to chert masses or nodules when seen in broken faces of the quarry rock. My attention first was drawn to them by specimens which, weathered free from the matrix, lay upon stripped surfaces or among the rubbish of the quarry floors; when broken, they showed the true nature of the "nodules" to be seen in the walls. A few of these, on close examination, showed concentric structure characteristic of the life-form of stromatoporoid which often finds its way into the literature as "*Stromatopora concentrica* Goldfuss." More could not be told from the silicified specimens generally available, while the few preserved in porous dolomite were barely distinguishable as the remains of organisms.

In numbers and mass, these stromatoporoids exceed by three or four times their closest rivals, the tabulates; and since there are in the Devonian (Traverse) of Michigan well-defined reefs of which stromatoporoids are almost the sole organic constituents,[9] it seems reasonable to conclude that these animals were the chief (though by no means the sole) builders of the Niagaran "coral" reefs of Illinois, Wisconsin, and probably of Indiana as well.

III. STROMATOPOROIDS AS REEF BUILDERS

Twitchell's apparently convincing evidence that the true stromatoporoids are sponges—siliceous sponges—gives rise to this question: How did siliceous-spiculed organisms related to the modern *Spongilla* provide material for rocks whose chief constituent is dolomite? Or how, for that matter, did they build others which are equally dominated by calcium carbonate?

To the first question no direct answer need be given unless it is shown that the dolomites of the Chicago region

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9 Fenton, M. A., Bull. Geol. Soc. Am., vol. 40, p. 244, 1929; also this journal and issue, 1931.

are primary — a supposition which the porous, shrunken nature of the rock seems to oppose. If we assume, therefore, that the dolomitization was secondary, we are confronted rather by the problem of the origin of calcium carbonate in an animal community dominated by siliceous sponges. It is not a problem which this paper can attempt to solve, but it is one on which a few pertinent comments may be made.

In the first place, the condition postulated by acceptance of true stromatoporoids as sponges is not so unheard-of as words may make it seem. Reefs built by undoubted siliceous sponges long have been known: for *Cnemidiastrum*, the dominant organism in the reefs of the Swabian White Jura, is a siliceous sponge — even though Grabau's reference to it as a lime-secreting form[10] suggests otherwise. In the second place, even horny sponges become calcified with such speed as to form fossils, and in the face of abundant evidence it is not, therefore, hard to believe that the stromatoporoids became calcified with at least equal rapidity. It is significant that in the stromatoporoid reefs near Petoskey, Michigan, Mrs. Fenton finds the stromatoporoid masses broken and angular; while in the Cedar Valley of Iowa, these organisms commonly show erosion prior to fossilization. In whatever way they may have accomplished it, there seems no doubt that the stromatoporoids accumulated calcium carbonate with all the speed necessary to fit them for the work of reef building; and even the fact that some of them are proving to be algae does not change the situation with regard to those which are sponges.

To some it may seem that such an accumulation of lime shows the stromatoporoids to be organisms other than siliceous Demospongiae. This phase of the problem lies beyond the scope of this paper; yet one comment may be allowed. Taxonomy is based on structure, not function or

10 Principles of Stratigraphy, p. 442, 1913.

preservation; it is the anatomy, not the material forming the fossil remains of organisms which determine their biologic place. If the anatomy (including the hollow spicules) of the stromatoporoids indicates their poriferoid nature, the manner of their preservation is hardly a sound contrary argument. Even in its own field this much may be said against it: that in the Niagaran reefs, many of the stromatoporoids are preserved in chert, even though it is quite probable that the majority are represented by dolomite.

IV. STRUCTURE OF THE REEFS

The structure of the reefs such as those described here has been reviewed recently by Cumings and Shrock,[11] who give a considerable bibliography of the subject. The reefs of the Chicago region, however, show a few characteristics upon which they do not comment, and which may be mentioned here.

Figure 1 shows one limb of a small reef at Thornton, in which there is one central and one lateral reef-mass, with accordant fluctuations in the dip of the strata covering

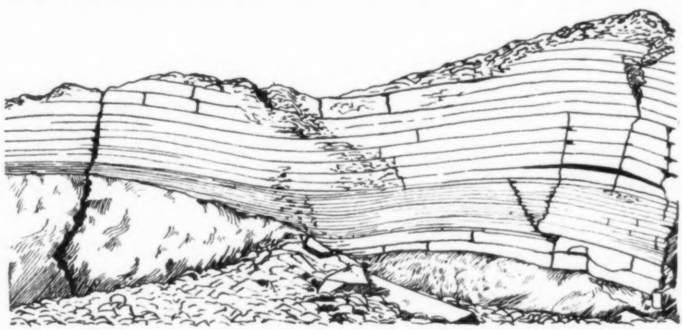

FIG. 1. Stromatoporoid reef or chapeiro at Thornton, Ill., showing lateral reef at the right. From a photograph by Dr. T. A. Link.

[11] Bull. Geol. Soc. Am., vol. 39, pp. 579-620, 1928.

them. The main fore-reef lies beyond the limits of the picture; it is divided by two beds of compact, massive dolomite, each eight to twelve inches in thickness, which lie directly above the lateral reef-mass. They are followed by thin-bedded dolomites whose thickness at the crest of the reef is about fourteen inches; and they in turn by the regularly bedded, domed strata overlying the entire reef.[12]

Figure 2 shows the partly truncated surface of strata overlying a dome-shaped reef, the steep, radiating dips marking the major strata. Apparently the reef was connected with, or closely adjoined a similar one, for at the right the strata strike outward to form one limb of a second dome. At the time of my first visit this second reef was destroyed, while only a portion of the one in the foreground remained. It closely resembled the reef of Figure 1

FIG. 2. Truncated, domed beds overlying a small reef at Thornton, Ill. From a photograph by Dr. T. A. Link.

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[12] Figures 1-3 are drawn from photographs made by Dr. T. A. Link, in the files of the College of Education of the University of Chicago, and loaned by Dr. E. R. Downing. They have been supplemented by field sketches made at various times, though in 1925 only the left reef of Figure 3 remained in the quarry wall.

except that dips in the fore-reef amounted to as much as thirty degrees.

In Figure 3 we see two reefs, one of which apparently followed the other in origin and so overlapped it, even though the first one continued to develop. As the drawing shows, the marginal portion of the second (left) reef grades into the fore-reef of the one at the right while (unlike the general condition) the flank rock thickens away from the reefs. This probably was caused by the accumulation of material from both in the central space between them. Another feature of interest is the small fold upon the flank of the reef at the right. It seems to have originated in slumping of the steeply inclined beds of the accumulating fore-reef; met by the resistance of the thicker and more massive sediments farther away from the reef, they were deformed into a moderate fold. Similar steepening of the soft or partly consolidated beds is common in the Illinois reefs, as in others, and it seems adequate to account for the dips of forty and more degrees to be found in some of them. Slickensides, common in the large reef forming Stony Island, in Chicago, probably indicate that the beds were sufficiently indurated at the time of steepening to preserve traces of their movement.

V. NATURE OF THE REEFS

Several authors have undertaken to classify the reefs of the Silurian in accordance with modern reefs. Thus Grabau, after describing the general characteristics of fossil reefs in various parts of North America, projects those of the Wisconsin-Illinois belt through northern Michigan and connects them with the Lockport coralline beds, making the whole an immense though rather disconnected barrier reef.[13] While it seems true that there is some such connection as Grabau postulates, Cumings and Shrock have shown that Niagaran reefs are widely dis-

[13] Principles of Stratigraphy, p. 420, 1913.

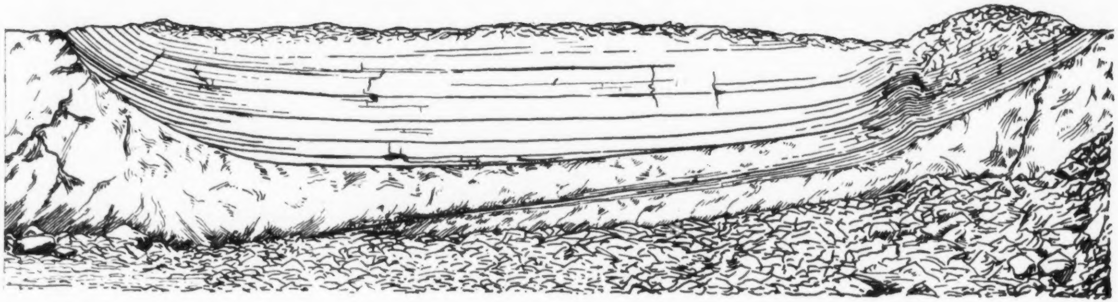

FIG. 3. Overlapping reefs (chapeiros) at Thornton, Ill. Note the gradation of the fore-reef at the right into the reef-foot at the left, and the folding of apparen tly slumped beds. From a photograph by Dr. T. A. Link.

tributed in Iowa, Indiana and Ohio,[14] thus forming a more nearly continuous reef belt south of the Great Lakes region. They agree with Grabau in placing the reefs in shallow waters near Niagaran shores; but they map a southern rather than a northern sea margin, and do not join him in regarding the reefs as part of a barrier. In this they seem justified, for the known Niagaran reefs possess neither the size, the degree of continuity nor the abundance which mark the constituents of modern major barriers. Rather, they are independent in origin even though commonly clustered, and form individual elevated areas upon a shallow marine platform.

If we consult the descriptions of modern reefs for analogues to these, and many others of the Paleozoic, we find that those which correspond most closely in the matter of origin are the so-called "chapeiros" of Brazil, described half a century ago by Hartt.[15] These reefs are relatively small and are isolated in their growth; "without spreading much, (they) ofen rise to the height of forty to fifty feet or more, like towers, and sometimes attain the level of low water . . . Some of these chapeiros are only a few feet in diameter." Although independent, they commonly are so clustered as to impede navigation, and in many cases they expand upward.

In all but minor respects, this description conforms to the essential characters of the Niagaran and Devonian stromatoporoid and coral reefs, as well as to the Jurassic sponge reefs already mentioned. So far as observed, however, the Paleozoic reefs do not form towers, nor do they expand upward. Typically they are round, but the largest of them form elongate, or subovate ridges. These peculiarities, however, do not seriously affect the nature of the reefs as determined by manner of growth and distribution; and these are the factors which seem most essential. So

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14 Bull. Geol. Soc. Am., vol. 39, p. 582, fig. 1, 1928.

15 Geology and Physical Geography of Brazil, pp. 191, 199-200, 1870.

far as can be determined from literature alone, they serve to unite the Paleozoic reefs with the chapeiros of Hartt.

VI. VALUE OF THE TERM CHAPEIRO

Cumings and Shrock stress this resemblance between chapeiros and the Niagaran reefs. They do not, however, directly employ the Brazilian term (whose meaning, literally, is "big hat") to the fossil reefs, even though some term which may specifically designate structures of their peculiar type seems badly needed. In spite of its local origin, the term chapeiro seems adequate for this purpose, and is no less acceptable than cuesta, graben, bergschrund and a dozen other European terms incorporated into geologic English. And if it seems undesirable on the ground that a word meaning "big hat" can possess significance in a discussion of reefs only by metaphoric use, must we not advance similar objection to our native geologic term hogback? The whole matter may seem insignificant to those who have not attempted to use existing terms in descriptions of Paleozoic reefs, or who have not tried to visualize those reefs as barriers or fringes upon a shallow, apparently almost islandless epicontinental marine platform. It seems that there is a real need for an appropriate term, to be applied in common usage; and this need the word chapeiro, already established in geologic literature, seems adequately to meet.

A PAIR OF ELK ANTLERS FROM ST. JOSEPH COUNTY, INDIANA*

MARCUS WARD LYON, JR.

SOUTH BEND, INDIANA

Elk antlers seined from Kankakee River, St. Joseph County, Indiana, by Mr. H. F. Goppert, of Walkerton.

Between 30 and 35 years ago, Mr. H. F. Goppert, of Walkerton, and several companions, were seining for fish in the Kankakee River, in St. Joseph County, close to the LaPorte County line. During one of the hauls the sein seemed to have caught on a snag but on drawing it in it was found to have caught a handsome pair of Elk (*Cervus canadensis* Erxleben) antlers. These antlers are now in the possession of Mr. Goppert and kept in his residence, a mile or so southwest of

* Read before the Indiana Academy of Science, December 5, 1930.

Walkerton. Through the kindness of Mr. and Mrs. Goppert, I was given the opportunity of carefully examining these antlers, measuring, and taking a photograph of them. This photograph is here reproduced.

The greater part of the cranial bones of the skull are present, the foramen magnum and occipital condyles being essentially intact. None of the facial portion of the skull is present. The antlers, themselves, are essentially perfect. They do not appear to be of any great antiquity and must certainly be regarded as Recent rather than Pleistocene in age. The fact that they were not buried in the river bed would bespeak their Recent origin, although the Kankakee flows through a region from which many Pleistocene mammal remains have been taken. There is not a break in the antlers and scarcely a scratch or worn spot on them.

The antlers and cranium together, weigh 23½ pounds. They are strikingly asymmetrical, the right appearing heavier and shorter and with eight points instead of the usual six seen on the left antler. In addition to the normal royal tine, the right antler bears a large accessory royal tine, about 12 inches in length and directed backward. The points of these two royal tines of the right antler can be seen in the picture, though rather indistinctly. The following measurements were made with Mrs. Goppert's tape measure:

Distance between terminal points,
37 inches (940 mm.)

Greatest width of the antlers,
45½ inches (1155 mm.)

Circumference of right antler above burr,
10½ inches (266 mm.)

Circumference of left antler above burr,
11¼ inches (285 mm.)

Length of right antler along convexity,
52 inches (1320 mm.)

Length of left antler along convexity,
$54\frac{1}{2}$ inches (1383 mm.)

Length of right brow tine, from burr,
14 inches (355 mm.)

Length of left brow tine, from burr,
$15\frac{1}{2}$ inches (394 mm.)

Distance between tips of the brow tines,
15 inches (381 mm.)

Other reports or records of Elk antlers in Indiana are: Dinwiddie, (1884, p. 151) "Elk horns have been found here and the inference is easily drawn that Elk once inhabited our [Lake] County."

Hahn (1909, p. 455) "There are pieces of elk antler in the State Museum from Jasper and Newton counties." These specimens are probably the ones referred to by Hay (1912, p. 618), who regarded them as of the Pleistocene Period. Numerous other finds of Elk are reported by him. One skull in particular, from Cambridge City, No. 5070, Earlham College collection, is regarded by Hay as probably belonging to "some part of the Recent epoch" (p. 619).

Mr. Henry Duncker, of South Bend, has in his possession some small elk antlers dug from the sides of the Kankakee drainage ditch in Laporte County. These are evidently of Pleistocene age.

Hahn (1909, p. 455) on the authority of the history of Dearborn and Ohio counties, refers to an elk's head found on Laughery Creek. This had an unbelievably large pair of antlers. With the tips of the antlers on the ground, the finder, Mr. Ben Moulten, could stand between them without touching the head. Hay (1912, p. 618) refers to a pair of antlers from Wabash County that is said to have "measured eight feet from tip to tip. It seems probable in making the measurement, the antlers were laid out with their shafts in the same line, for no elk is known to have had antlers of this

extent." It is unfortunate that neither of these apparently giant specimens were preserved.

According to Hay (1912, p. 617) the elk "was a late comer into this region." Its remains are absent in the earlier part of the Pleistocene. An annotated list of all known Indiana finds of elk of the Pleistocene are given by him in 1923 (pp. 238, 239, and map 23). During early historic times elk were generally found throughout Indiana. Hahn (1909, p. 455) gives the last probable occurrence of wild elk in the state as about 1830.

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NEW AND INTERESTING PLANT RECORDS FROM NORTHERN INDIANA*

J. A. NIEUWLAND AND TH. JUST

The following new and interesting records of plants, chiefly from St. Joseph County and vicinity, are mostly recently made, or within the last two years. Some of these reports suggest that a more painstaking search would undoubtedly lead to still more important finds because, although many of the natural habitats are rapidly being destroyed, specimens often remain a long time in unfavorable conditions before finally disappearing altogether.

Lycopodium obscurum L.: Tamarack Bog, Chain of Lakes, VII. 20. 1930.

Lycopodium complanatum L.: Tamarack Swamp, 6 miles SW of South Bend, Wolverton's Estate, VII. 20., VIII. 1. 1930.

Thelypteris hexagonoptera (Michx.) Weatherby: 5 miles E of Pin Hook Bog, VII. 20. 1921, woods; 3 miles NE of Pin Hook Bog, VII. 20. 1929, Laporte Co.; Woods N of Wharton Lake, VII. 20. 1930.

Pinus Strobus L.: Turkey Creek Tamarack Swamp, VI. 25. 1930.

Arisaema deflexum *n. sp.*:

Diphyllum vel monophyllum (plantae masculae), dioicum. Plantae masculae: semper minores, 3.5-circ. 4.5dm altae, monophyllae. Tuber subglobosum vel ovoideum, 1-1.5cm diametiens; cataphylla membranacea. Folia tenuipetiolata, petiolis 1.5-2-plo longioribus quam laminae, vaginatis. Folii lamina trisecta, segmentis sessilibus, ellipticis, subaequilongis, 7-14cm longis, 3.5-6cm latis, perviridibus, intermedio regulari, lateralibus obliquis, basi cuneato-angustatis (intermedio atque latere interiore segmentorum lateralium)

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* Read before the Indiana Academy of Science, December 5, 1930.

usque oblique obtusatis, omnibus apice abrupte cuneatis, acutis, semper cuspidato-acuminatis.

Plantae femineae majores, 6-8.5dm altae, diphyllae (rare monophyllae). Tuber subglobosum, 1.5-2cm diametiens, radiculis tenuibus dense instructum; cataphylla atque petioli purpurascenti- vel purpureo-variegati. Foliorum petioli subaequilongi vel segmentis paullum longiores, 1.8-2.8dm longi, 2-5mm crassi, lamina trisecta, segmentis sessilibus, rhombeo-ellipticis, 10.5-25cm longis, 7-14cm latis, perviridibus, subtus paullum pallidioribus, intermedio regulari basi cuneato-angustato, lateralibus valde inaequilateralibus, latere exteriore basi oblique obtusato vel rotundato, prope basin amplissimo, quam interius saepe latiore, apice similibus illis plantarum mascularum semper in aristam 1.5-3mm longam exientibus, nervis lateralibus inter se 0.5-circ.1.5cm distantibus, in nervum collectivum a margine circ.0.5cm remotum conjunctis.

Inflorescentia mascula: longe pedunculata, pedunculo spatha longiore. Inflorescentia feminea: breviter pedunculata, pedunculo spatha breviore, ultimam vaginam superans. Spathae femineae extus purpurascentis tubus inter nervos lacteos purpureo-vittatus, subinfundibuliformis, fauce aperta marginibus leviter recurvis 4-5.5cm longus, lamina appresso-deflexa ovato-lanceolata 5.5-7cm longa apice acuminata longe aristata, atro-purpurea atque lacteo-vittata cum nervis ad apicem sensim vanescentibus (maxime in plantis defloratis). Spathae masculae tubus ei spathae femineae similis 3cm longus, extus lacteolo-coloratus, intus quam in tubu femineo vittatus, lamina atro-purpurea apice longissime aristata. Spadicis masculi inflorescentia sessilis, laxiflora, 3-6mm longa, circ. 2mm crassa, appendix breviter et tenuiter stipitata 3cm longa, mox paullum incrassata, ad apicem rotundatam usque cylindrica, gracilis, atropurpurea. Spadicis feminei inflorescentia sessilis, densiflora, 1-1.5cm diametiens, appendix breviter stipitata, 4-5cm longa, 3mm crassa, appendici spadicis masculi similis (conformis). Stigma peltato-capitatum, subsessile.

In order to show the systematic position of this species we give an analytical key to the species known from the northeastern states. It is based on the one in Britton & Brown: Illustrated Flora, vol. I, p. 442, 2nd ed.

Spadix club-shaped; spathe spreading; leaves pale beneath. 1) *A. triphyllum.*

Spadix cylindric; leaves green on both sides.

Leaf-segments acuminate (merely acute) at the apex; spathe deflexed.

*[Spathe smooth, deep brown to black. 2) *A. pusillum.*]

[Spathe fluted, green or striped. 3) *A. Stewardsonii.*]

Leaf-segments always long-aristate at the apex; spathe blackish-purple, inner face with cream-colored stripes, the apex long aristate. 4) *A. deflexum.*

The main differences from *A. triphyllum* are: leaves abruptly blunt-pointed, acute to acuminate, always long-aristate (bristle-pointed); spathe: blackish-purple, with cream-colored narrower stripes, long-aristate tip, free portion emphatically deflexed; spadix: upper portion cylindrical, gradually tapering towards the inflorescence, rounded at the apex, of the same color as the spathe.

Type locality: Tamarack Swamp, Turkey Creek Road, VI. 15., VI. 25. 1930.

This plant is in bloom for a month to a month and a half after *A. triphyllum,* and is always found in wet, shady bogs. It occurs in the swamps of the northernmost counties. It is even more abundant across the boundary in Michigan although we have found it in several places in Indiana. The lateness of its occurrence is not due to peculiar seasons of wetness in swamps. Its apparently well-limited time of growth is only about 2 or 3 weeks. One can readily see why the plants have been overlooked since their

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* The parentheses indicate that the species does not occur within our area.

characters can not well be made out by herbarium specimens in as much as these dry poorly for all members of the genus. They must be studied in the field.

Lemna minor L.: blooming specimens were found at Interlaken, VII. 4. 1929, Laporte, Co.

Heteranthera dubia (Jacq.) MacM.: St. Mary's Lake at Old College, Notre Dame, X. 1915, 1923.

Blephariglottis psychodes (L.) Rydb.: Notre Dame Grounds, I. I. I. RR., VIII. 23. 1927.

Isotria verticillata (Willd.) Raf.: Pin Hook Bog, VII. 20. 1929, VI. 8. 1930., Laporte Co.

Serapias Helleborine L.: Interlaken, Laporte Co., spreading very rapidly in abundance on a dry clay hillside facing the lake, VII. 18. 1930. (Probably introduced).

Ulmus Thomasi Sarg.: Studebaker's Woods, S of South Bend, VI. 2. 1929, IX. 11. 1913.

Cycloloma atriplicifolium (Spreng.) Coult.: I. I. I. RR. at Notre Dame, IX. 24. 1914. Near Chain Lakes, Lincoln Highway, IX. 12. 1930.

Dianthus Armeria L.: escaped in St. Joseph Co., N of St. Mary's Academy, V. 24. 1929.

Nymphaea variegata G. S. Miller: Interlaken, VII. 18. 1930, Laporte Co.

Berberis Thunbergii DC.: escaped in St. Joseph Co. River Bank, St. Mary's Academy, IV. 29. 1930, leg. P. E. Hebert.

Argemone mexicana L.: Webster's Crossing, N of Notre Dame, VI. 13. 1930.

Conringia orientalis (L.) Dumort: I. I. I. RR., Notre Dame, summer 1919.

Diplotaxis tenuifolia (L.) DC.: near Kankakee River, Greene Township 19, VII. 8. 1930.

Drymocallis agrimonioides (Pursh) Rydb.: Notre Dame Grounds, VII. 17. 1925.

Rosa setigera Michx.: SE of Bremen, Marshall Co., common along road sides, VII. 4. 1930. E of Lagrange, Lagrange Co., VII. 13. 1930.

Sorbus scopulina Greene: Tamarack Swamp, 6 miles SW of South Bend, Wolverton's Estate, VII. 6. 1930, VIII. 1. 1930. Tamarack Swamp, 2½ miles NE of Walkerton, Oliver Hardy's Estate, VII. 27. 1930. About 20 trees, low and small, in three patches, some fruiting abundantly are found 6 miles SW of South Bend on the N. Liberty Highway. Growing on the edge of a white and black oak woods facing an open bog to the north. Near these is *Lycopodium complanatum* already referred to. Some of these trees were about 5 inches in diameter. In a Tamarack swamp near North Liberty, associated with *Betula lutea, Vaccinium corymbosum* and *Acer saccharinum* is a single tree about 4-5 inches in diameter, in fruit. Beneath it and some distance away numerous seedlings had developed.

Coronilla varia L.: East of Lagrange, Lagrange Co., VII. 13. 1930.

Poinsettia dentata (Michx.) Small: Mich. Centr. RR. at St. Mary's, X. 1. 1924, also along fences in South Bend.

Schmaltzia crenata (Mill.) Greene: Scout's Camp, NW of Notre Dame, X. 2. 1924. Near 4-mile bridge along St. Joseph River, VIII. 28. 1925, X. 12. 1930.

Rhamus Frangula L.: escaped and abundant at Interlaken, Laporte Co., VII. 20. 1925, VII. 1926, VII. 18. 1930.

Viola primulifolia L.: Chain Lakes, VI. 8. 1930.

Cubelium concolor (Forst.) Raf.: St. Mary's, near St. Joseph River, V. 16. 1916, V. 11. 1916. St. Joseph River, I. I. I. RR., VIII. 3. 1916. SW of Notre Dame, I. I. I. RR., VI. 13. 1916, VII. 7. 1924, VI. 2. 1925, Notre Dame, VI. 11. 1929.

Opuntia humifusa Raf.: Notre Dame, grave yard, summer 1927.

Dirca palustris L.: 2 miles W of Milford, Woods, VII. 4. 1930, Kosciusko Co.

Lepargyraea argentea (Nutt.) Greene: Notre Dame, VI. 2. 1925.

Epilobium hirsutum L.: Notre Dame, Ice House, VIII. 27. 1925.

Gaura coccinea Pursh: Lydick, N. Y. C. RR., VI. 15. 1930.

Gaura biennis L.: Notre Dame, near I. I. I. RR. bridge, VIII. 30. 1915. Notre Dame, VIII. 20. 1917, VIII. 29. 1924, near River, X. 2. 1924.

Pyrola chlorantha Sw.: Chain of Lakes, N of Bass Lake, Tamarack Swamp, VI. 18. 1930.

Hypopitys lanuginosa (Michx.) Nutt.: Chain of Lakes, VII. 1922.

Oxycoccus palustris Pers.: Pin Hook Bog, VI. 5. 1929, VI. 8. 1930, Laporte Co.; Pigeon River, Tamarack Swamp, VII. 13. 1930, Lagrange Co.

Gentiana quinquefolia L.: Banks of St. Joseph River, NW of Notre Dame, VIII. 10. 1918, X. 12. 1930.

Dasystephana flavida (A. Gray) Britton: Notre Dame, VIII. 12. 1917.

Acerates floridana (Lam.) Hitchc.: Road 2 miles SW of Walkerton, VII. 27. 1930. 10-11 miles NE of Knox, Starke Co., VII. 23. 1930.

Phlox glaberrima L.: 6 miles NE of Knox, Starke Co., VII. 23. 1930.

Phlox Stellaria Gray: River Bank, St. Mary's Academy, P. E. Hebert, IV. 27. 1930.

Phlox subulata L.: Webster's Crossing and N of it, V. 4. 1911; 6 miles N of Notre Dame, near boundary, V. 12. 1930.

Collinsia verna Nutt.: has been found again in St. Joseph Co. (after having disappeared 15 years ago.) Studebaker's Woods, South Bend, V. 26. 1910. Notre Dame, 1930.

Synthyris Bullii (Eaton) Heller: St. Joseph River Bank, Notre Dame, VI. 6. 1911, 1919, VI. 5. 1930.

Utricularia cornuta Michx.: 6 mile Swamp, SW of South Bend, VII. 6. 1930.

Thalesia uniflora (L.) Britton: Ravine near Indian Grave Yard, Notre Dame, VI. 9. 1930.

Ruellia ciliosa Pursh: Notre Dame, Road to Novitiate, VIII. 7. 1924, VIII. 3. 1929; Healthwin, N of St. Mary's, VII. 30. 1924, Notre Dame, VIII. 20. 1917, VIII. 29. 1924.

Plantago Purshii R. & S.: I. I. I. RR., W of Notre Dame, Juncture, Mich. Centr. RR. and I. I. I. RR. tracks, VII. 5. 1929, leg. P. E. Hebert.

Plantago virginica L.: St. Mary's, Notre Dame, VI. 16. 1916. Notre Dame, Science Hall, VI. 29. 1929.

Diodia teres Walt.: M. C. RR., Notre Dame, VIII. 7. 1918.

Diervilla Lonicera Mill.: Interlaken, VII. 4. 1929, Laporte Co. Most eastern record in northern counties.

Ambrosia psilostachya DC.: Woods SE of Notre Dame, IX. 27. 1930.

Solidago rigida L.: Notre Dame, VIII. 27. 1918.

Polymnia canadensis L.: 2 mi. W of Milford, woods, VII. 4. 1930, Kosciusko Co.

Parthenium integrifolium L.: Interlaken, N. Y. C. RR., VII. 4. 1929, Laporte Co.

Echinacea pallida Nutt.: Hudson Lake, VII. 25. 1916, Laporte Co. Lydick, near railroad, 1915.

Coreopsis grandiflora Hogg.: escaped in St. Joseph Co., near South Bend, Lincoln Highway, VI. 15. 1930. Becoming very abundant.

Centaurea vochinensis Bernh.: Notre Dame, VIII. 12. 1914.

Galinsoga parviflora Cav.: Notre Dame, Lyons Hall, IX. 27. 1930. First found this year.

SEVERAL FORMS OF NATIVE AND NATURALIZED TREES

A. D. SLAVIN

The forms of the several species described here are the discoveries of Bernard H. Slavin, Superintendent of Parks, Rochester, New York. All have proven of great value, especially for street tree planting and are now being propagated in large numbers by Mr. Slavin for this work. Observations of both type and propagated trees have convinced me that the distinct characteristics of these forms warrant their being described and named.

Tilia glabra Ventenat forma **fastigiata** f. n.

Arbuscula pyramidalis, 8.6 m alta et 3 m lata. Truncus erectus, rami densi et fastigiati. Folia glabra, basi oblique cordata, longe acuminata, distincte serrata 11-18 cm longa et 7.5-12 cm lata.

Rochester, New York, Genesee Valley Park. (type) Bernard H. Slavin No. 1, June 17, 1924. Herbarium, Rochester Bureau of Parks No. 44541. June 30, 1927.

This tree although only about twenty years old has attained a height of 8.6 meters. Being of pyramidal habit its width is but 3 meters. Such a narrow upright form of *Tilia glabra* is quite rare. Unlike most members of the species it does not have a broad, spreading top formed by a system of horizontal or ascending branches. It has instead a single main stem extending the entire length of the tree and lateral branches which are dense and erect. These secondary branches project from the main stem at an angle of about 20 degrees from the perpendicular. A short distance from their base they appear to curve in and then grow parallel to the main stem. The leaves differ only slightly from the straight species. They are broad-ovate, long acuminate, obliquely

cordate, and coarsely serrate with long pointed teeth. They are 11-18 centimeters long and 7.5-12 centimeters wide.

Acer platanoides L. forma **erectum** f. n.

Arbor pyramidalis, 11 m alta et 2.9 m lata. Truncus erectus; rami robusti, breves et ascendentes. Folia atroviridia, 9-17.3 cm. longa et 16-26 cm lata.

Rochester, New York, Mt. Hope Cemetery (type) Bernard H. Slavin No. 1, July 9, 1915. Herbarium, Rochester, New York, No. 33840, October 7, 1921.

Pyramidal in shape, this tree, although young (about 25 years) is a distinct form. At the present time it measures 9.7 meters in height and has a maximum spread of 2.9 meters. The leaves are a darker green than those of the species and are 16-26 centimeters wide and 9-17.3 centimeters long. The outstanding feature of this form is its distinct branching habit. The main stem is straight and erect and extends the entire length of the tree. The lateral branches are stout, short, and ascending. Unlike most upright deciduous trees, this form does not obtain its shape from an upright branching habit but rather by a system of short lateral branches which come from the single main stem. Due to its mode of growth, this tree will, as it becomes older, undoubtedly attain a height considerably greater than most forms of the species.

Acer platanoides f. *columnare* Carr, must not be confused with the tree described here. Carr's form has smaller and lighter colored foliage as well as longer and more upright branches.

Ulmus americana L. forma **ascendens** f. n.

Arbor columnaris, 23.2 m alta et 5.1 m lata. Truncus dimidio altitudinis arboris longior. Rami valde fastigiati. Cortex canus, leviter sulcatus, arborum juvenilium ramorumque glaber. Folia ovato-oblonga, 7.3-14 cm longa et 4.8-8.5 cm lata, utrinque pubescentes. Gemmae florum minutae atque steriles, 2-3 mm longae. Flores steriles.

Rochester, New York, Seneca Park. (type) Bernard H. Slavin No. 1, May 24, 1904. Herbarium, Bureau of Parks, Rochester, New York, No. 32555, June 21, 1927.

This tree is very columnar in habit and is 23.2 meters high with a maximum spread of 5.1 meters. The main stem, which is .71 meters in diameter near the base, extends for more than one-half the height of the tree before it divides into close growing erect branches. The lateral branches are quite small and fastigiate, forming, at the crown, a narrow oval head. The bark is grey but much less furrowed than the straight *Ulmus americana*. On trees and branches less than eighteen years old the bark is smooth. The leaves are similar in shape to those of the species and are 7.3-14 centimeters long and 4.8-8.5 centimeters wide. They are pubescent on both sides. The flower buds are small and aborted. They are few in number and are 2-3 millimeters long. No flowers have ever been found during the twenty-five years that Mr. Slavin has known the tree.

In the Jour. Arnold Arboretum Vol. III, p. 42, (1923) Mr. Alfred Rehder describes an upright form which he calls *U. americana f. columnaris* and, in his description, mentions the tree discovered by Mr. Slavin as a related form. In this regard I am inclined to believe that Mr. Rehder was not furnished with complete material, the tree described here being quite distinct from his form and of greater variance from the species. As to the upright character of *var. columnaris* Rehder, I am forced to consider that condition due, at least partially, to mechanical causes. This has been proven in our nursery where 1,000 plants of each form have been propagated. (Propagating material in all cases was taken from the type trees.) Observations carried on over a period of ten years show that Rehder's form lost, more or less, its upright habit while the tree from Seneca Park came true to form in all cases.

Bureau of Parks, Rochester, New York.

BOOK REVIEWS

THE BIOLOGICAL BASIS OF HUMAN NATURE. H. S. Jennings, 384 pp. W. W. Norton and Company, New York. $4.00

In this book, one of America's foremost biologists, writing with the modesty and caution so characteristic of genuine scholarship, presents those aspects of modern experimental biology that are of greatest interest in the consideration of human personality and society.

The author bases his discussion on the genes of the reproductive of cells. Although these are not taken very seriously by certain biophysicists, they are considered by many biologists to embody in their origin, composition, and structure the central problem of biology today. Through a discussion of what is known of the genes and their relations with one another in the fertilized egg, he exposes the fallacies of many current ideas on the subject of heredity. Because it does not require a likeness of parents to offspring, we may not assume that superior individuals must necessarily come from superior parents, nor that this will continue to happen. The various recombinations of the genes may produce defectives as well as normals, fools or knaves, as well as geniuses. Thus parents both of whom are dull, foolish, lacking in ambition, may produce children that have none of these defects, but who are quick, intelligent, industrious, ambitious, thus constituting what we call superior individuals. Dr. Jennings believes that, in large measure, this is the origin of superiority or genius in man. History, he reminds us, does not provide superior parents for Lincoln, Shakespeare, or Keats. If one can not logically assume from available data that biology requires an aristocratic constitution of society, neither

can he support a theory of democracy based on the assumption that all individuals are alike, but only the kind of democracy that produces experts.

Does all of this do away with eugenics? Not at all. Merit is conceded its proposal with regard to extreme defects, such as feeble-mindedness and insanity, but the unjunctions given it are: (1) devise a way of recognizing the normal carriers of defective genes and control their propagation; (2) correct the environmental ills first, so that you may clearly see the real source of the defects. The latter course will involve the treatment of infants, the modification of education, tradition, economic situations, and the like. In the author's opinion, more can be done in this way for the ills of society than through the direct attempts of eugenics to change the hereditary constitution of the population.

Professor Jennings reacts no less pointedly to those who hold extreme views such as the behaviorists as to the effects of the environment. He can not logically grant that because all important human characteristics are environmental, environment itself is all important, and heredity unimportant in human affairs. To say that heredity does play a role is only to say that changing the genes with which an individual begins would alter the behavior, attitudes, temperaments or characteristics of the individual; it does not imply in the least that example, education, tradition, and the like have no effect. It is regrettable, however, that at a time when biological science has brought to general recognition the importance of individuality, the Watsonian gospel of a super-biology arrives to tell the world it is all a mistake, and the world (faddishly enough) shows a tendency to swallow it! In the author's estimation, the whole of Watson's contention appears to be a marked example of drawing negative conclusions from positive observations, of holding that the discovery of one cause requires the exclusion of another.

The troublesome problem of racial mixtures is dealt with in a purely scientific way. They result, for example, in inharmonious details of bodily organization such as large teeth in small jaws and a high percentage of dental infirmities. One race may be superior in some respects and inferior in others; all depends on the relative worth of its features. Thus with regard to whites and blacks, the latter have been found to be superior in matters involving musical ability; whites, in matters of judgment and of adjustment to conditions. With regard to the future of racial problems, a selective elimination of many present combinations is predicted, with the final emergence of a relatively homogeneous race, combining the elements of the others. Through such a process have arisen the races of the present day.

In conclusion the two diverse doctrines of evolution basic to the materials of the book are discussed with their relation to the pursuit of science in life. From the prevailing view of mechanism, purely physico-chemical in viewpoint, and which represent itself as distinctly scientific, it is derived that ideas, purposes, ideals, and all that we call mental, have no influence on the course of events; for such things are not masses or motions or arrangements and can not be taken into the computations by which the mechanist predicts things, — for him the test of science. It follows from such a philosophy that things mental have no function in the production of the universe and in evolution, and that we are not agents in working out the world formula. Continued recourse to experimentation is seen by this theory to be but the device of feeble minds; an attempt to discover in a rude manner what we should know from an examination of any small part of the universe by mathematics and logic. One recalls at this point the taunts earlier hurled by the mechanist at the vitalist, especially when the author indicates how mechanical science had led to fatalism and the extinction of all stimulus to effort.

The other view of evolution, which avoids many of the difficulties of mechanism, holds that evolution is creative and that in its operation essentially new things and new methods of action emerge. These develop from a pre-existing situation in which they did not occur. Thus, in the past history of the world there was a time when sensations, feelings, and the like did not occur, for the requisite conditions were not present. A great many things, in that hypothesis arose, or emerged in the process of evolution, things that could not be predicted by computations based on what existed before they arose. Changes of this kind are what is meant by emergent evolution. They represent more nearly what might be called the humanistic point of view. For it observation and experiment will always be primary; hence science must be the organization of experience. Accordingly, Doctor Jennings sees in the doctrine of emergent evolution the declaration of independence of biology from the status of a purely physico-chemical science, for the desires and aspirations of humanity are determiners in the operation of the universe, and on the same footing with physical determiners.

It follows that the biologist who will endeavor to speak authoritatively on the problems of human life must be a specialist on the biology of man, just as an authority on the Japanese beetle must be a specialist in entomology. He must therefore be a student, an experimenter, an actor in the social life of man; he must be an economist, a politician, a historian, as well as a physiologist. For such an authority emergent evolution is a correct doctrine. The proper study of mankind is man, — man taken of course in his setting as an organism and as part of the world, yet man as a distinct emergent, a creature in his own right. There is much in this volume that is of value to biologists, educators, sociologists, and theologians, and we must acknowledge our indebtedness to Doctor Jennings for a stimulating and timely contribution.—N. M. Grier.

HEREDITY AND PARENTHOOD. Samuel C. Schmucker. The MacMillan Company. $2.50.

Chautauquaesque; an example of how popularizing a subject may lead to superficiality of treatment. The work is anthropomorphic at times, inaccurate at others, and if the largely irrevelant material were omitted, the more valuable information could be condensed to a book half of its size. Why do not present day popularizers take a lesson from Huxley?—N. M. Grier.